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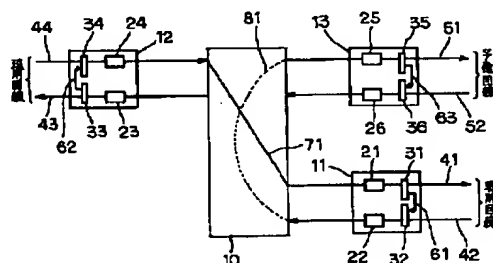
(54) **FAILURE RESTORATION METHOD FOR ATM EXCHANGING DEVICE**

(57) Abstract:

PROBLEM TO BE SOLVED: To reduce time required for failure restoration after a line failure detection, to flexibly deal with the failure and to prevent a cell discard by the line fault.

SOLUTION: In an ATM exchanging device, a PVC 71 of a normal route is provided between an input line 44 for an active line and an output line 41 of the active line, and a PVC 81 of a bypass route is provided between an input line 42 of the active line and an output line 51 of a standby line; when a line failure of the output line 41 is detected, an autonomous changeover is performed from the PVC 71 of the normal route to the PVC 81 of the bypass, and a cell is transmitted by using the output line 51 of the standby line.

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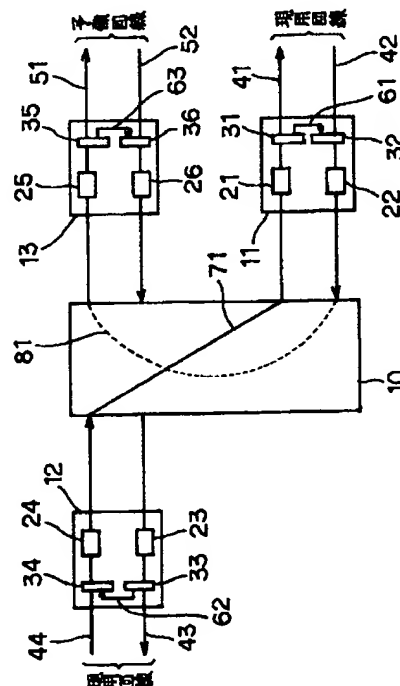
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(54)【発明の名称】 ATM交換機の障害復旧方法

(57)【要約】

【課題】 回線障害検出時の障害復旧までの時間を短くし、障害にフレキシブルに対応して、回線障害によるセル廃棄を防止する。

【解決手段】 現用回線の入力回線44と現用回線の出力回線41との間に通常ルートのPVC71が設定され、現用回線の入力回線42と予備回線の出力回線51との間に迂回ルートのPVC81が設定されているATM交換機であって、出力回線41の回線障害を検出したときには、通常ルートのPVC71から迂回ルートのPVC81への自律的な切替えを行い、予備回線の出力回線51を用いてセルを送出する。



【特許請求の範囲】

【請求項1】 現用回線の第1の入出力回線と現用回線の第2の入出力回線との間に通常ルートのPVC (Permanent Virtual Connection) が設定され、該現用回線と予備回線との間に迂回ルートのPVCが設定されているATM交換機において、

該第1の入出力回線の第1の出力回線の回線障害を検出したときには、該通常ルートのPVCから該迂回ルートのPVCへの自律的な切替えを行い、該予備回線の出力回線を用いてセルを送出することを特徴とする、ATM交換機の障害復旧方法。

【請求項2】 現用回線の第1の入出力回線と現用回線の第2の入出力回線との間に通常ルートのPVCが設定され、該現用回線と予備回線との間に迂回ルートのPVCが設定されているATM交換機において、該第1の入出力回線の第1の出力回線の回線障害を検出したときには、該ATM交換機の手続きが備える選択手段を切り替えて、該回線手段が備えるヘッダ交換手段にあらかじめ設定されている迂回ルートの出力回線テーブルを参照して、該第1の出力回線に向かう該通常ルートのPVCを流れる全てのセルデータを、回線障害が検出されていない該予備回線の出力回線に向かう該迂回ルートのPVCに流れるように切り替えることを特徴とする、ATM交換機の障害復旧方法。

【請求項3】 現用回線の第1の入出力回線と現用回線の第2の入出力回線との間に通常ルートのPVCが設定され、該現用回線と複数の予備回線との間に複数の迂回ルートのPVCが設定されているATM交換機において、該第1の入出力回線の第1の出力回線および該複数の予備回線のうちの任意の第1の入出力回線の出力回線の回線障害を検出したときには、該ATM交換機の手続きが備える選択手段を切り替えて、該回線手段が備えるヘッダ交換手段にあらかじめ設定されている迂回ルートの出力回線テーブルを参照して、該第1の出力回線に向かう該通常ルートのPVCを流れる全てのセルデータを、該複数の予備回線のうちの回線障害が検出されていない第2の予備回線の出力回線に向かう該迂回ルートのPVCに流れるように切り替えることを特徴とする、ATM交換機の障害復旧方法。

【請求項4】 現用回線の第1の入出力回線と現用回線の第2の入出力回線との間に通常ルートのPVCが設定され、該現用回線と第1の予備回線との間に第1の迂回ルートのPVCが設定されているATM交換機において、

該第1の入出力回線の第1の出力回線および該第1の予備回線の出力回線の回線障害を検出したときには、該ATM交換機の手続きが備える選択手段を切り替えて、該回線手段が備えるヘッダ交換手段にあらかじめ設定されている迂回ルートの出力回線テーブルを参照して、新

たな第2の予備回線を設定して、該第1の予備回線と該第2の予備回線との間に第2の迂回ルートのPVCを設定し、該第1の出力回線に向かう該通常ルートのPVCを流れる全てのセルデータを、回線障害が検出されていない該第2の予備回線の出力回線に向かう該迂回ルートのPVCに流れるように切り替えることを特徴とする、ATM交換機の障害復旧方法。

【請求項5】 前記迂回ルートのPVCのパスを終端する場合には、前記回線手段が備えるヘッダ交換手段がVPI値およびVCI値のマージを行うことを特徴とする、請求項2ないし4のいずれか1項に記載のATM交換機の障害復旧方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明はATM交換機に関し、特にATMネットワークにおけるパス障害発生時の迂回方法に関する。

【0002】

【従来の技術】従来の技術の例として、特開平8-251184号公報（以下、公報1と記述する）に記載されている短瞬断切替回路および無瞬断切替回路の発明がある。公報1に記載されている発明は、HEC誤り検出部が現用伝送路のHEC誤りを検出し、誤りが検出された場合には、現用伝送路および予備伝送路の2本の回線を物理的に収容するセレクトを用いて、現用伝送路から物理的に固定された特定の予備伝送路への切替えを行っている。

【0003】また、他の従来の技術の例として、特開平8-242240号公報（以下、公報2と記述する）に記載されているATM交換機およびパス切替方法の発明がある。公報2に記載されている発明は、スイッチ内に、通常運用時に参照するルーティングテーブルと障害検出時に参照する迂回ルーティングテーブルとの両方を保持し、障害の検出の有無に応じて参照するルーティングテーブルを変えて、通常ルートまたは迂回ルートの選択を行っている。

【0004】

【発明が解決しようとする課題】上記従来の技術の公報1に記載された発明の問題点としては、現用伝送路に障害が生じた場合には物理的に固定された予備伝送路への切替えを行うが、現用伝送路および予備伝送路の両系に障害が生じた場合には障害を回避することができないということがあげられる。また、回線のn重化（ $n > 1$ ）を実現する場合には、n本の回線を収容するセレクトが必要となるということがあげられる。

【0005】また、公報2に記載された発明の問題点としては、通常時に使用するルーティングテーブルと障害発生時に参照するルーティングテーブルとの2種類のルーティングテーブルを保持する必要があるため、実装メモリの容量によってはATM交換機の性能が制限されて

しまうということがあげられる。

【0006】本発明は先に述べた課題をふまえて提案されたものであり、障害復旧までの時間を短くし、障害にフレキシブルに対応して、回線障害によるセル廃棄を防止することを目的としている。

【0007】

【課題を解決するための手段】

〔1〕本発明のATM交換機の障害復旧方法は、現用回線の第1の入出力回線(42, 41)と現用回線の第2の入出力回線(44, 43)との間に通常ルートのPVC(71)が設定され、該現用回線と予備回線(51, 52)との間に迂回ルートのPVC(81)が設定されているATM交換機であって、該第1の入出力回線の第1の出力回線(41)の回線障害を検出したときには、該通常ルートのPVC(71)から該迂回ルートのPVC(81)への自律的な切替えを行い、該予備回線の出力回線(51)を用いてセルを送出する。

【0008】〔2〕本発明のATM交換機の障害復旧方法は、現用回線の第1の入出力回線(42, 41)と現用回線の第2の入出力回線(44, 43)との間に通常ルートのPVC(71)が設定され、該現用回線と予備回線(51, 52)との間に迂回ルートのPVC(81)が設定されているATM交換機であって、該第1の入出力回線の第1の出力回線(41)の回線障害を検出したときには、該ATM交換機の回線手段(11)が備える選択手段(31, 32)を切り替えて、該回線手段が備えるヘッダ変換手段(22)にあらかじめ設定されている迂回ルートの出力回線テーブルを参照して、該第1の出力回線に向かう該通常ルートのPVC(71)を流れる全てのセルデータを、回線障害が検出されていない該予備回線の出力回線(51)に向かう該迂回ルートのPVC(81)に流れるように切り替える。

【0009】〔3〕本発明のATM交換機の障害復旧方法は、現用回線の第1の入出力回線(42, 41)と現用回線の第2の入出力回線(44, 43)との間に通常ルートのPVC(71)が設定され、該現用回線と複数の予備回線(51, 52, 53, 54)との間に複数の迂回ルートのPVC(81, 91)が設定されているATM交換機であって、該第1の入出力回線の第1の出力回線(41)および該複数の予備回線(51, 52, 53, 54)のうちの任意の第1の入出力回線(51, 52)の出力回線(51)の回線障害を検出したときには、該ATM交換機の回線手段(11, 13)が備える選択手段(31, 32, 35, 36)を切り替えて、該回線手段が備えるヘッダ変換手段(22, 26)にあらかじめ設定されている迂回ルートの出力回線テーブルを参照して、該第1の出力回線に向かう該通常ルートのPVC(71)を流れる全てのセルデータを、該複数の予備回線のうちの回線障害が検出されていない第2の予備回線(53, 54)の出力回線(53)に向かう該迂回

ルートのPVC(91)に流れるように切り替える。

【0010】〔4〕本発明のATM交換機の障害復旧方法は、現用回線の第1の入出力回線(42, 41)と現用回線の第2の入出力回線(44, 43)との間に通常ルートのPVC(71)が設定され、該現用回線と第1の予備回線(51, 52)との間に第1の迂回ルートのPVC(81)が設定されているATM交換機であって、該第1の入出力回線の第1の出力回線(41)および該第1の予備回線(51, 52)の出力回線(51)の回線障害を検出したときには、該ATM交換機の回線手段(11, 13)が備える選択手段(31, 32, 35, 36)を切り替えて、該回線手段が備えるヘッダ変換手段(22, 26)にあらかじめ設定されている迂回ルートの出力回線テーブルを参照して、新たな第2の予備回線(53, 54)を設定して、該第1の予備回線と該第2の予備回線との間に第2の迂回ルートのPVC(91)を設定し、該第1の出力回線に向かう該通常ルートのPVC(71)を流れる全てのセルデータを、回線障害が検出されていない該第2の予備回線の出力回線(53)に向かう該迂回ルートのPVC(91)に流れるように切り替える。

【0011】〔5〕上記〔2〕～〔4〕の本発明のATM交換機の障害復旧方法は、前記迂回ルートのPVCのパスを終端する場合には、前記回線手段が備えるヘッダ変換部がVPI値およびVCI値のマージを行うことができる。

【0012】

【発明の実施の形態】以下、本発明の実施の形態を図面を参照して説明する。

【0013】〔第1の実施の形態〕図1は、本発明の第1の実施の形態における障害復旧方法が適用されるATM交換機の構成を示す図である。図1を用いて、現用出力回線で障害が検出された場合の障害復旧方法を説明する。

【0014】図1に示したATM交換機は、スイッチ10と、現用系のラインカードインターフェース部11, 12と、予備系のラインカードインターフェース部13とを有する構成となっている。ラインカードインターフェース部11は、セルのヘッダを書き換えるヘッダ変換部21, 22と、通常ルートまたは迂回ルートを選択するセクタ31, 32と、迂回ルート選択用のループバックパス61とを有する構成となっている。ラインカードインターフェース部12は、セルのヘッダを書き換えるヘッダ変換部23, 24と、通常ルートまたは迂回ルートを選択するセクタ33, 34と、迂回ルート選択用のループバックパス62とを有する構成となっている。ラインカードインターフェース部13は、セルのヘッダを書き換えるヘッダ変換部25, 26と、通常ルートまたは迂回ルートを選択するセクタ35, 36と、迂回ルート選択用のループバックパス63とを有する構

成となっている。また、現用系のラインカードインターフェース部11には、障害が検出されていない場合に使用される現用回線41、42が接続されている。現用系のラインカードインターフェース部12には、障害が検出されていない場合に使用される現用回線43、44が接続されている。予備系のラインカードインターフェース部13には、障害が検出された場合に使用される予備回線51、52が接続されている。

【0015】スイッチ10には、現用回線41～44と予備回線51、52とが設定されており、現用回線41と現用回線44との間には、通常ルート71が設定されている。また、現用回線41、42には、あらかじめループバックパス61が設定されている。現用回線43、44には、あらかじめループバックパス62が設定されている。予備回線51、52には、あらかじめループバックパス63が設定されている。さらに、スイッチ10には、あらかじめ現用回線42と予備回線51との間に、迂回ルート81が設定されている。

【0016】図1には示していないが、ヘッダ変換部21～26はそれぞれ、ヘッダのVPI値/VC I値と出力回線との対応テーブルAを備えている。回線障害が検出されていないときには、ヘッダ変換部21～26はそれぞれ、対応テーブルAを参照して、入力されるセルのヘッダ変換を行う。また、入力回線側のヘッダ変換部22、24、26はそれぞれ、回線障害時の迂回ルートの出力回線番号のみが書かれているテーブルBをも備えている。回線障害が検出されているときには、ヘッダ変換部22、24、26はそれぞれ、テーブルBを用いて、ループバックパス61～63を介して入力されるセルのヘッダ変換を行う。

【0017】セクタ31は、回線障害の有無によって現用回線の出力回線（以下、現用出力回線と記述する）41とループバックパス61との切替えを行い、セクタ32は、回線障害の有無によって現用回線の入力回線（以下、現用入力回線と記述する）42とループバックパス61との切替えを行い、回線障害を検出したときにはループバックパス61を選択して、迂回ルート81を介して、予備回線の出力回線（以下、予備出力回線と記述する）51にセルを出力する。セクタ33は、回線障害の有無によって現用出力回線43とループバックパス62との切替えを行い、セクタ34は、回線障害の有無によって現用入力回線44とループバックパス62との切替えを行う。セクタ35は、回線障害の有無によって予備出力回線51とループバックパス63との切替えを行い、セクタ36は、回線障害の有無によって予備回線の入力回線（以下、予備入力回線と記述する）52とループバックパス63との切替えを行う。

【0018】図1において、障害が検出されていない場合には、セクタ34は現用入力回線44を選択しており、セクタ31は現用出力回線41を選択している。

現用入力回線44に到着したセルは、セクタ34を介して、ヘッダ変換部24で対応テーブルAを参照してヘッダの付け替えが行われ、スイッチ10でスイッチングされて通常ルート71を経由して、ヘッダ変換部21で対応テーブルAを参照してヘッダの付け替えが行われ、セクタ31を介して現用出力回線41から送出される。

【0019】また、現用出力回線41で何らかの回線障害が検出された場合には、セクタ31は現用出力回線41からループバックパス61に自律的に選択を切替え、セクタ32は現用入力回線42からループバックパス61に自律的に選択を切替える。そして、現用入力回線44に到着したセルは、セクタ34を介して、ヘッダ変換部24の対応テーブルAを参照してヘッダの付け替えが行われ、通常ルート71を経由してスイッチ10でスイッチングされ、ヘッダ変換部21を介してセクタ31に到着する。ここまでは、回線障害が検出されていない場合と同じルートを通る。ここで、セクタ31がループバックパス61を選択しているので、セクタ31に到着したセルは、ループバックパス61を介して、セクタ32からヘッダ変換部22にフォワードされる。ヘッダ変換部22は、セクタ32がループバックパス61を選択しているので、対応テーブルAではなくテーブルBを参照して、各回線に設定を行う迂回ルート81の出力回線番号によって、セルに付加されるヘッダ内の出力回線番号の書き換えを行う。ヘッダの書き換えが行われたセルは、ヘッダ変換部22からスイッチ10に設定されている迂回ルート81を経由して、ヘッダ変換部25およびセクタ35を介して予備出力回線51に出力される。

【0020】〔第2の実施の形態〕図2は、本発明の第2の実施の形態における障害復旧方法が適用されるATM交換機の構成を示す図である。図2を用いて、現用出力回線および予備出力回線の両方で障害が検出された場合の障害復旧方法を説明する。

【0021】図2に示したATM交換機は、スイッチ10と、現用系のラインカードインターフェース部11、12と、予備系のラインカードインターフェース部13、14とを有する構成となっている。ラインカードインターフェース部11は、セルのヘッダを書き換えるヘッダ変換部21、22と、通常ルートまたは迂回ルートを選択するセクタ31、32と、迂回ルート選択用のループバックパス61とを有する構成となっている。ラインカードインターフェース部12は、セルのヘッダを書き換えるヘッダ変換部23、24と、通常ルートまたは迂回ルートを選択するセクタ33、34と、迂回ルート選択用のループバックパス62とを有する構成となっている。ラインカードインターフェース部13は、セルのヘッダを書き換えるヘッダ変換部25、26と、通常ルートまたは迂回ルートを選択するセクタ35、3

6と、迂回ルート選択用のループバックパス63とを有する構成となっている。ラインカードインターフェース部14は、セルのヘッダを書き換えるヘッダ変換部27、28と、通常ルートまたは迂回ルートを選択するセクタ37、38と、迂回ルート選択用のループバックパス64とを有する構成となっている。また、現用系のラインカードインターフェース部11には、障害が検出されていない場合に使用される現用回線41、42が接続されている。現用系のラインカードインターフェース部12には、障害が検出されていない場合に使用される現用回線43、44が接続されている。予備系のラインカードインターフェース部13には、障害が検出された場合に使用される予備回線51、52が接続されている。予備系のラインカードインターフェース部14には、障害が検出された場合に使用される予備回線53、54が接続されている。

【0022】スイッチ10には、現用回線41～44と予備回線51～54とが設定されており、現用入力回線44と現用出力回線41との間には通常ルート71が設定されている。また、現用回線41、42には、あらかじめループバックパス61が設定されている。現用回線43、44には、あらかじめループバックパス62が設定されている。予備回線51、52には、あらかじめループバックパス63が設定されている。予備回線53、54には、あらかじめループバックパス64が設定されている。さらに、スイッチ10にはあらかじめ、現用入力回線42と予備出力回線51との間に迂回ルート81が設定されており、予備入力回線52と予備出力回線53との間に迂回ルート91が設定されている。

【0023】図2には示していないが、ヘッダ変換部21～28はそれぞれ、ヘッダのVPI値/VCI値と出力回線との対応テーブルAを備えている。回線障害が検出されていないときには、ヘッダ変換部21～28はそれぞれ、対応テーブルAを参照して、入力されるセルのヘッダ変換を行う。また、入力回線側のヘッダ変換部22、24、26、28はそれぞれ、回線障害時の迂回ルートの出力回線番号のみが書かれているテーブルBをも備えている。回線障害が検出されているときには、ヘッダ変換部22、24、26、28はそれぞれ、テーブルBを用いて、ループバックパス61～64を介して入力されるセルのヘッダ変換を行う。

【0024】セクタ31は、回線障害の有無によって現用出力回線41とループバックパス61との切替えを行い、セクタ32は、回線障害の有無によって現用入力回線42とループバックパス61との切替えを行い、回線障害を検出したときにはループバックパス61を選択して、迂回ルート81を介して予備出力回線51にセルを出力する。セクタ33は、回線障害の有無によって現用出力回線43とループバックパス62との切替えを行い、セクタ34は、回線障害の有無によって現用

入力回線44とループバックパス62との切替えを行う。セクタ35は、回線障害の有無によって予備出力回線51とループバックパス63との切替えを行い、セクタ36は、回線障害の有無によって予備入力回線52とループバックパス63との切替えを行い、回線障害を検出したときにはループバックパス63を選択して、迂回ルート91を介して予備出力回線53にセルを出力する。セクタ37は、回線障害の有無によって予備出力回線53とループバックパス64との切替えを行い、セクタ38は、回線障害の有無によって予備入力回線54とループバックパス64との切替えを行う。

【0025】図2において、障害が検出されていない場合には、図1を用いて説明した第1の実施の形態と同じルートでセルが伝送される。また、現用出力回線41で障害が検出された場合には、図1を用いて説明した第1の実施の形態と同様に、セクタ31は現用出力回線41からループバックパス61に選択を切替え、セクタ32は現用入力回線42からループバックパス61に選択を切替える。現用入力回線44に到着したセルは、スイッチ10でスイッチングされて通常ルート71を経由して、ループバックパス61を介して、スイッチ10でスイッチングされて迂回ルート81を経由して、予備出力回線51から送出される。

【0026】ここで、現用出力回線41だけでなく予備出力回線51においても障害が検出されたとする。その場合には、セクタ35は予備出力回線51からループバックパス63に自律的に選択を切替え、セクタ36は予備入力回線52からループバックパス63に自律的に選択を切替える。そして、セクタ35がループバックパス63を選択しているため、迂回ルート81を介してセクタ35に到着したセルは、ループバックパス63を介して、セクタ36からヘッダ変換部26にフォワードされる。ヘッダ変換部26は、セクタ36がループバックパス63を選択しているため、対応テーブルAではなくテーブルBを参照して、各回線に設定を行う迂回ルート91の出力回線番号によって、セルに付加されるヘッダ内の出力回線番号の書き換えを行う。ヘッダの書き換えが行われたセルは、ヘッダ変換部26からスイッチ10に設定されている迂回ルート91を経由して、ヘッダ変換部27およびセクタ37を介して予備出力回線53に出力される。

【0027】第2の実施の形態においては、迂回ルート91をあらかじめ設定したが、障害が発生したときに新たに設定しても良い。

【0028】また、本発明において、回線障害を検出して迂回ルートを使用した場合に、PVCを終端する最終段のヘッダ変換部で、到着したセルのヘッダのVPI値/VCI値を、受信側の端末やアプリケーションが受信可能な値にマージする機構を持たせることもできる。

【0029】

【発明の効果】以上説明したように本発明は、ATM交換機のスイッチ内にあらかじめ予備回線への迂回ルートを設定しておき、現用回線で回線障害を検出したときには、ループバックパスをセレクトで自律的に選択することによって、物理接続を一箇所折り返すのみで、迂回ルートを使用して予備回線にセルを転送することができ、障害復旧までの時間を短くして、回線障害によるセル廃棄を防止することができるという効果を有する。

【0030】また、あらかじめ設定されている現用回線および予備回線の両方で回線障害が検出された場合であっても、あらかじめまたは回線障害検出時に複数の予備回線を設定することによって、回線障害が検出された予備回線で同様の機構を利用することができ、フレキシブルに回線障害に対応し、障害を回避することができるという効果を有する。このとき、回線の n 重化($n>1$)を行う場合にも、新たに n 本の回線を収容するセレクトを構築する必要がないという効果を有する。

【0031】さらに、迂回ルートを選択してヘッダ変換を行うときに使用するテーブルとして、通常ルート利用時に使用するルーティングテーブルと同じようなテーブ

ルを持つ必要がなく、予備回線にスイッチングする出力回線番号のみを保持することによって、実装メモリの有効活用を図ることができるという効果を有する。

【図面の簡単な説明】

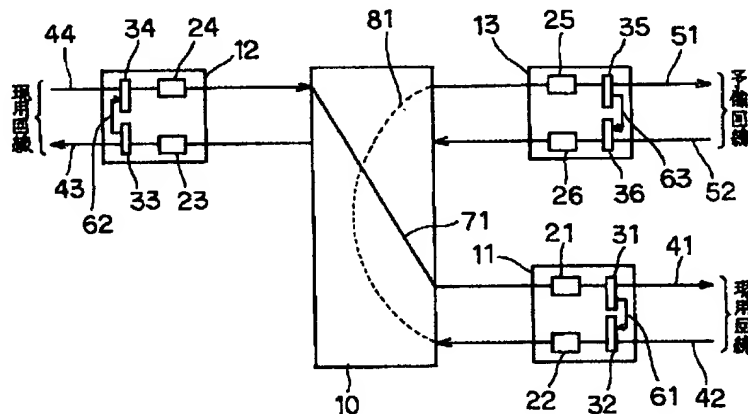
【図1】本発明の第1の実施の形態における障害復旧方法が適用されるATM交換機の構成を示すブロック図

【図2】本発明の第2の実施の形態における障害復旧方法が適用されるATM交換機の構成を示すブロック図

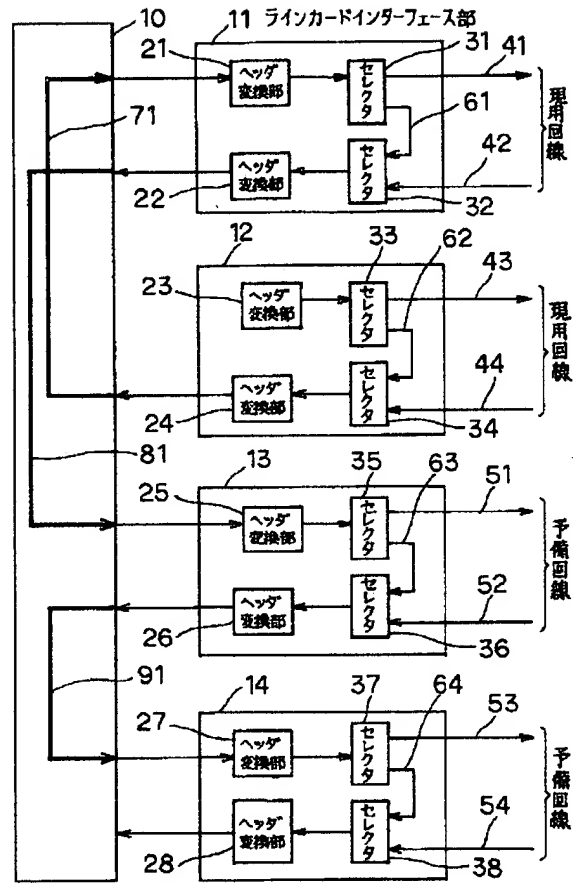
【符号の説明】

- 10 スイッチ
- 11～14 ラインカードインターフェース部
- 21～28 ヘッダ変換部
- 31～38 セレクト
- 41, 43 現用出力回線
- 42, 44 現用入力回線
- 51, 53 予備出力回線
- 52, 54 予備入力回線
- 61～64 ループバックパス
- 71 通常ルート
- 81, 91 迂回ルート

【図1】



【図2】



PATENT ABSTRACTS OF JAPAN

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(71)Applicant : NEC CORP

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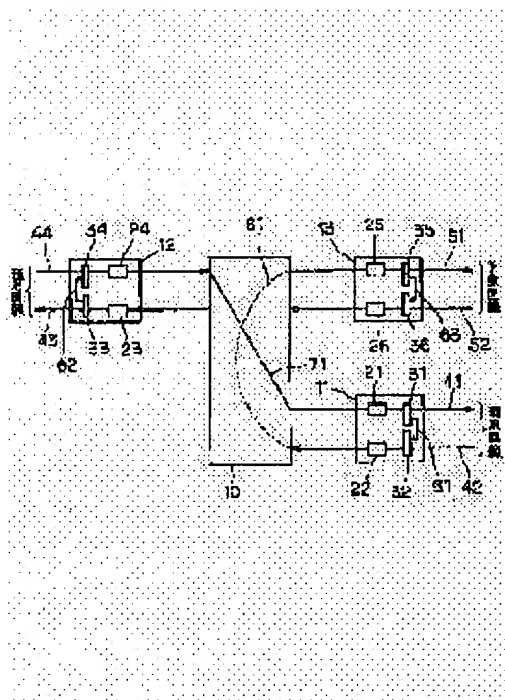
(72)Inventor : KUMASOE KAZUMI

(54) FAILURE RESTORATION METHOD FOR ATM EXCHANGING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce time required for failure restoration after a line failure detection, to flexibly deal with the failure and to prevent a cell discard by the line fault.

SOLUTION: In an ATM exchanging device, a PVC 71 of a normal route is provided between an input line 44 for an active line and an output line 41 of the active line, and a PVC 81 of a bypass route is provided between an input line 42 of the active line and an output line 51 of a standby line; when a line failure of the output line 41 is detected, an autonomous changeover is performed from the PVC 71 of the normal route to the PVC 81 of the bypass, and a cell is transmitted by using the output line 51 of the standby line.



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CLAIMS

[Claim(s)]

[Claim 1] PVC (Permanent Virtual Connection) of the root is usually set up between the 2nd I/O circuit of a circuit. present -- business -- the 1st I/O circuit of a circuit -- present -- business -- this -- present -- business -- the ATM switching system by which PVC of an alternative route is set up between the circuit and the reserved circuit -- setting -- this, when the line failure of the 1st output circuit of the 1st I/O circuit is detected The failure restoration approach of an ATM switching system which performs the autonomous change to PVC of this alternative route of this usual root from PVC, and is characterized by sending out a cel using the output circuit of this reserved circuit.

[Claim 2] In the ATM switching system by which PVC of an alternative route is set up between the circuit and the reserved circuit present -- business -- the 1st I/O circuit of a circuit -- present -- business -- - PVC of the root usually sets up between the 2nd I/O circuit of a circuit -- having -- this -- present -- business -- this, when the line failure of the 1st output circuit of the 1st I/O circuit is detected Change the selection means with which the circuit means of this ATM switching system is equipped, and the output circuit table of the alternative route beforehand set as the header conversion means with which this circuit means is equipped is referred to. this -- the failure restoration approach of an ATM switching system characterized by changing all the cell datas that flow PVC of this usual root which goes to the 1st output circuit so that it may flow to PVC of this alternative route that goes to the output circuit of this reserved circuit by which the line failure is not detected.

[Claim 3] In the ATM switching system by which PVC of two or more alternative routes is set up between a circuit and two or more reserved circuits present -- business -- the 1st I/O circuit of a circuit -- present -- business -- PVC of the root usually sets up between the 2nd I/O circuit of a circuit -- having -- this -- present -- business -- this, when the line failure of the output circuit of the 1st output circuit of the 1st I/O circuit and the 1st I/O circuit of the arbitration of these two or more reserved circuits is detected Change the selection means with which the circuit means of this ATM switching system is equipped, and the output circuit table of the alternative route beforehand set as the header conversion means with which this circuit means is equipped is referred to. this -- all the cell datas that flow PVC of this usual root which goes to the 1st output circuit The failure restoration approach of an ATM switching system characterized by changing so that it may flow to PVC of this alternative route that goes to the output circuit of the 2nd reserved circuit by which the line failure of these two or more reserved circuits is not detected.

[Claim 4] In the ATM switching system by which PVC of the 1st alternative route is set up between a circuit and the 1st reserved circuit present -- business -- the 1st I/O circuit of a circuit -- present -- business -- PVC of the root usually sets up between the 2nd I/O circuit of a circuit -- having -- this -- present -- business -- this, when the line failure of the 1st output circuit of the 1st I/O circuit and the output circuit of this 1st reserved circuit is detected Change the selection means with which the circuit means of this ATM switching system is equipped, and the output circuit table of the alternative route beforehand set as the header conversion means with which this circuit means is equipped is referred to. Set up the 2nd new reserved circuit and PVC of the 2nd alternative route is set up between this 1st

reserved circuit and this 2nd reserved circuit. this -- the failure restoration approach of an ATM switching system characterized by changing all the cell datas that flow PVC of this usual root which goes to the 1st output circuit so that it may flow to PVC of this alternative route that goes to the output circuit of this 2nd reserved circuit by which the line failure is not detected.

[Claim 5] The failure restoration approach of an ATM switching system given in claim 2 thru/or any 1 term of 4 characterized by the header transducer with which said circuit means is equipped performing merge of a VPI value and a VCI value in carrying out termination of the pass of PVC of said alternative route.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the detour approach at the time of pass failure generating in an ATM network about an ATM switching system.

[0002]

[Description of the Prior Art] As an example of a Prior art, there is invention of the short hits electronic switch indicated by JP,8-251184,A (it is hereafter described as an official report 1) and a non-hits electronic switch. invention indicated by the official report 1 -- the HEC error detection section -- present -- business -- the case where detected the HEC error of a transmission line and an error is detected -- present -- business -- the selector which holds physically two circuits, a transmission line and a reserve transmission line, -- using -- present -- business -- the change to the specific reserve transmission line fixed physically from a transmission line is performed.

[0003] Moreover, there is invention of the ATM switching system indicated by JP,8-242240,A (it is hereafter described as an official report 2) and the pass change approach as an example of other Prior arts. In the switch, invention indicated by the official report 2 holds both the routing table usually referred to at the time of employment, and the detour routing table referred to at the time of failure detection, changes the routing table referred to according to the existence of detection of a failure, and is usually performing selection of the root or an alternative route.

[0004]

[Problem(s) to be Solved by the Invention] as the trouble of invention indicated by the official report 1 of the above-mentioned Prior art -- present -- business -- although the change to the reserve transmission line fixed physically is performed when a failure arises in a transmission line -- present -- business -- when a failure arises in the both system of a transmission line and a reserve transmission line, it is raised that a failure is unavoidable. Moreover, when realizing n-fold-ization ($n > 1$) of a circuit, it is raised that the selector which holds n circuits is needed.

[0005] Moreover, since it is necessary to hold two kinds of routing table of the sometimes used

[usually] routing table and the routing table referred to at the time of failure generating as a trouble of invention indicated by the official report 2, it is raised that the engine performance of an ATM switching system will be restricted depending on the capacity of mounting memory.

[0006] This invention is proposed based on the technical problem described previously, shortens time amount to failure restoration, corresponds to a failure flexibly, and it aims at preventing the cel abandonment by the line failure.

[0007]

[Means for Solving the Problem]

[1] The failure restoration approach of the ATM switching system of this invention PVC (71) of the root is usually set up between the 2nd I/O circuit (44 43) of a circuit. present -- business -- the 1st I/O circuit (42 41) of a circuit -- present -- business -- It is the ATM switching system by which PVC (81) of an alternative route is set up between the circuit and the reserved circuit (51 52). this -- present -- business -

- this -- when the line failure of the 1st output circuit (41) of the 1st I/O circuit is detected, the autonomous change to PVC of this alternative route of this usual root (81) from PVC (71) is performed, and a cel is sent out using the output circuit (51) of this reserved circuit.

[0008] [2] The failure restoration approach of the ATM switching system of this invention PVC (71) of the root is usually set up between the 2nd I/O circuit (44 43) of a circuit. present -- business -- the 1st I/O circuit (42 41) of a circuit -- present -- business -- It is the ATM switching system by which PVC (81) of an alternative route is set up between the circuit and the reserved circuit (51 52). this -- present -- business -- this, when the line failure of the 1st output circuit (41) of the 1st I/O circuit is detected Change the selection means (31 32) with which the circuit means (11) of this ATM switching system is equipped, and the output circuit table of the alternative route beforehand set as the header conversion means (22) with which this circuit means is equipped is referred to. this -- all the cell datas that flow PVC (71) of this usual root which goes to the 1st output circuit are changed so that it may flow to PVC (81) of this alternative route that goes to the output circuit (51) of this reserved circuit by which the line failure is not detected.

[0009] [3] The failure restoration approach of the ATM switching system of this invention PVC (71) of the root is usually set up between the 2nd I/O circuit (44 43) of a circuit. present -- business -- the 1st I/O circuit (42 41) of a circuit -- present -- business -- It is the ATM switching system by which PVC (81 91) of two or more alternative routes is set up between a circuit and two or more reserved circuits (51, 52, 53, 54). this -- present -- business -- this, when the line failure of the output circuit (51) of the 1st output circuit (41) of the 1st I/O circuit and the 1st I/O circuit (51 52) of the arbitration of these two or more reserved circuits (51, 52, 53, 54) is detected The selection means (31, 32, 35, 36) with which the circuit means (11 13) of this ATM switching system is equipped is changed. The output circuit table of the alternative route beforehand set as the header conversion means (22 26) with which this circuit means is equipped is referred to. this -- all the cell datas that flow PVC (71) of this usual root which goes to the 1st output circuit are changed so that it may flow to PVC (91) of this alternative route that goes to the output circuit (53) of the 2nd reserved circuit (53 54) by which the line failure of these two or more reserved circuits is not detected.

[0010] [4] The failure restoration approach of the ATM switching system of this invention PVC (71) of the root is usually set up between the 2nd I/O circuit (44 43) of a circuit. present -- business -- the 1st I/O circuit (42 41) of a circuit -- present -- business -- It is the ATM switching system by which PVC (81) of the 1st alternative route is set up between a circuit and the 1st reserved circuit (51 52). this -- present -- business -- this, when the line failure of the 1st output circuit (41) of the 1st I/O circuit and the output circuit (51) of this 1st reserved circuit (51 52) is detected The selection means (31, 32, 35, 36) with which the circuit means (11 13) of this ATM switching system is equipped is changed. The output circuit table of the alternative route beforehand set as the header conversion means (22 26) with which this circuit means is equipped is referred to. Set up the 2nd new reserved circuit (53 54), and PVC (91) of the 2nd alternative route is set up between this 1st reserved circuit and this 2nd reserved circuit. this -- all the cell datas that flow PVC (71) of this usual root which goes to the 1st output circuit are changed so that it may flow to PVC (91) of this alternative route that goes to the output circuit (53) of this 2nd reserved circuit by which the line failure is not detected.

[0011] [5] The above [2] When the failure restoration approach of the ATM switching system of this invention of - [4] carries out termination of the pass of PVC of said alternative route, the header transducer with which said circuit means is equipped can perform merge of a VPI value and a VCI value.

[0012]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.

[0013] [Gestalt of the 1st operation] drawing 1 is drawing showing the configuration of the ATM switching system to which the failure restoration approach in the gestalt of operation of the 1st of this invention is applied. drawing 1 -- using -- present -- business -- the failure restoration approach when a failure is detected by the output circuit is explained.

[0014] the ATM switching system shown in drawing 1 -- a switch 10 -- present -- business -- it has the composition of having the Rhine card interface sections 11 and 12 of a system, and the Rhine card interface section 13 of a reserve system. The Rhine card interface section 11 has the composition of having the header transducers 21 and 22 which rewrite the header of a cel, the selectors 31 and 32 which usually choose the root or an alternative route, and the loop-formation back pass 61 for alternative route selection. The Rhine card interface section 12 has the composition of having the header transducers 23 and 24 which rewrite the header of a cel, the selectors 33 and 34 which usually choose the root or an alternative route, and the loop-formation back pass 62 for alternative route selection. The Rhine card interface section 13 has the composition of having the header transducers 25 and 26 which rewrite the header of a cel, the selectors 35 and 36 which usually choose the root or an alternative route, and the loop-formation back pass 63 for alternative route selection. moreover -- present -- business -- when the failure is not detected by the Rhine card interface section 11 of a system, it is used for it -- present -- business -- circuits 41 and 42 are connected. present -- business -- when the failure is not detected by the Rhine card interface section 12 of a system, it is used for it -- present -- business -- circuits 43 and 44 are connected. The reserved circuits 51 and 52 used when a failure is detected are connected to the Rhine card interface section 13 of a reserve system.

[0015] a switch 10 -- present -- business -- circuits 41-44 and reserved circuits 51 and 52 set up -- having -- **** -- present -- business -- a circuit 41 -- present -- business -- between circuits 44, the root 71 is usually set up. moreover -- present -- business -- the loop-formation back pass 61 is beforehand set to circuits 41 and 42. present -- business -- the loop-formation back pass 62 is beforehand set to circuits 43 and 44. The loop-formation back pass 63 is beforehand set to reserved circuits 51 and 52. furthermore -- a switch 10 -- beforehand -- present -- business -- the alternative route 81 is set up between the circuit 42 and the reserved circuit 51.

[0016] Although not shown in drawing 1, the header transducers 21-26 are equipped with the correspondence table A of the VPI value / VCI value of a header, and an output circuit, respectively. When the line failure is not detected, the header transducers 21-26 perform header conversion of the cel inputted with reference to the correspondence table A, respectively. Moreover, the header transducers 22, 24, and 26 by the side of an input circuit are equipped with the table B on which only the output line number of the alternative route at the time of a line failure is written, respectively. When the line failure is detected, the header transducers 22, 24, and 26 perform header conversion of the cel inputted through the loop-formation back passes 61-63 using Table B, respectively.

[0017] The change to the output circuit (the following -- present -- business -- it is described as an output circuit) 41 of a circuit and the loop-formation back pass 61 is performed. a selector 31 -- the existence of a line failure -- present -- business -- a selector 32 When the change to the input circuit (the following -- present -- business -- it is described as an input circuit) 42 of a circuit and the loop-formation back pass 61 is performed and a line failure is detected, the loop-formation back pass 61 is chosen. the existence of a line failure -- present -- business -- A cel is outputted to the output circuit (it is hereafter described as a preliminary output circuit) 51 of a reserved circuit through an alternative route 81. a selector 33 -- the existence of a line failure -- present -- business -- the change to the output circuit 43 and the loop-formation back pass 62 -- carrying out -- a selector 34 -- the existence of a line failure -- present -- business -- the change to the input circuit 44 and the loop-formation back pass 62 is performed. A selector 35 performs the change to the preliminary output circuit 51 and the loop-formation back pass 63 by the existence of a line failure, and a selector 36 performs the change to the input circuit (it is hereafter described as a preliminary input circuit) 52 of a reserved circuit, and the loop-formation back pass 63 by the existence of a line failure.

[0018] the case where the failure is not detected in drawing 1 -- a selector 34 -- present -- business -- the input circuit 44 -- choosing -- **** -- a selector 31 -- present -- business -- the output circuit 41 is chosen. present -- business -- through a selector 34, with reference to the correspondence table A, a replacement of a header is performed by the header transducer 24, the cel which reached the input circuit 44 is switched with a switch 10, and a replacement of a header usually performs it with reference to the correspondence table A by the header transducer 21 via the root 71 -- having -- a selector 31 -- minding -

- present -- business -- it is sent out from the output circuit 41.

[0019] moreover -- present -- business -- the case where a certain line failure is detected by the output circuit 41 -- a selector 31 -- present -- business -- the loop-formation back pass 61 from the output circuit 41 -- autonomous -- selection -- changing -- a selector 32 -- present -- business -- selection is autonomously changed from the input circuit 42 to the loop-formation back pass 61. and -- present -- business -- through a selector 34, a replacement of a header is performed with reference to the correspondence table A of the header transducer 24, and the cel which reached the input circuit 44 is usually switched with a switch 10 via the root 71, and reaches a selector 31 through the header transducer 21. It passes along the root same so far as the case where the line failure is not detected. Here, since the selector 31 has chosen the loop-formation back pass 61, it acts to the header transducer 22 as the forward of the cel which reached the selector 31 from a selector 32 through the loop-formation back pass 61. Since the selector 32 has chosen the loop-formation back pass 61, the header transducer 22 rewrites the output line number in the header added to a cel not with reference to the correspondence table A but with reference to the table B with the output line number of the alternative route 81 which sets it as each circuit. The cel in which rewriting of a header was performed is outputted to the preliminary output circuit 51 through the header transducer 25 and a selector 35 via the alternative route 81 set as the switch 10 from the header transducer 22.

[0020] [Gestalt of the 2nd operation] drawing 2 is drawing showing the configuration of the ATM switching system to which the failure restoration approach in the gestalt of operation of the 2nd of this invention is applied. drawing 2 -- using -- present -- business -- the failure restoration approach when a failure is detected by both the output circuit and the preliminary output circuit is explained.

[0021] the ATM switching system shown in drawing 2 -- a switch 10 -- present -- business -- it has the composition of having the Rhine card interface sections 11 and 12 of a system, and the Rhine card interface sections 13 and 14 of a reserve system. The Rhine card interface section 11 has the composition of having the header transducers 21 and 22 which rewrite the header of a cel, the selectors 31 and 32 which usually choose the root or an alternative route, and the loop-formation back pass 61 for alternative route selection. The Rhine card interface section 12 has the composition of having the header transducers 23 and 24 which rewrite the header of a cel, the selectors 33 and 34 which usually choose the root or an alternative route, and the loop-formation back pass 62 for alternative route selection. The Rhine card interface section 13 has the composition of having the header transducers 25 and 26 which rewrite the header of a cel, the selectors 35 and 36 which usually choose the root or an alternative route, and the loop-formation back pass 63 for alternative route selection. The Rhine card interface section 14 has the composition of having the header transducers 27 and 28 which rewrite the header of a cel, the selectors 37 and 38 which usually choose the root or an alternative route, and the loop-formation back pass 64 for alternative route selection. moreover -- present -- business -- when the failure is not detected by the Rhine card interface section 11 of a system, it is used for it -- present -- business -- circuits 41 and 42 are connected. present -- business -- when the failure is not detected by the Rhine card interface section 12 of a system, it is used for it -- present -- business -- circuits 43 and 44 are connected. The reserved circuits 51 and 52 used when a failure is detected are connected to the Rhine card interface section 13 of a reserve system. The reserved circuits 53 and 54 used when a failure is detected are connected to the Rhine card interface section 14 of a reserve system.

[0022] a switch 10 -- present -- business -- circuits 41-44 and reserved circuits 51-54 set up -- having -- **** -- present -- business -- the input circuit 44 -- present -- business -- between the output circuits 41, the root 71 is usually set up. moreover -- present -- business -- the loop-formation back pass 61 is beforehand set to circuits 41 and 42. present -- business -- the loop-formation back pass 62 is beforehand set to circuits 43 and 44. The loop-formation back pass 63 is beforehand set to reserved circuits 51 and 52. The loop-formation back pass 64 is beforehand set to reserved circuits 53 and 54. furthermore -- a switch 10 -- beforehand -- present -- business -- the alternative route 81 is set up between the input circuit 42 and the preliminary output circuit 51, and the alternative route 91 is set up between the preliminary input circuit 52 and the preliminary output circuit 53.

[0023] Although not shown in drawing 2, the header transducers 21-28 are equipped with the

correspondence table A of the VPI value / VCI value of a header, and an output circuit, respectively. When the line failure is not detected, the header transducers 21-28 perform header conversion of the cel inputted with reference to the correspondence table A, respectively. Moreover, the header transducers 22, 24, 26, and 28 by the side of an input circuit are equipped with the table B on which only the output line number of the alternative route at the time of a line failure is written, respectively. When the line failure is detected, the header transducers 22, 24, 26, and 28 perform header conversion of the cel inputted through the loop-formation back passes 61-64 using Table B, respectively.

[0024] a selector 31 -- the existence of a line failure -- present -- business -- the change to the output circuit 41 and the loop-formation back pass 61 -- carrying out -- a selector 32 -- the existence of a line failure -- present -- business -- the change to the input circuit 42 and the loop-formation back pass 61 is performed, when a line failure is detected, the loop-formation back pass 61 is chosen, and a cel is outputted to the preliminary output circuit 51 through an alternative route 81. a selector 33 -- the existence of a line failure -- present -- business -- the change to the output circuit 43 and the loop-formation back pass 62 -- carrying out -- a selector 34 -- the existence of a line failure -- present -- business -- the change to the input circuit 44 and the loop-formation back pass 62 is performed. A selector 35 performs the change to the preliminary output circuit 51 and the loop-formation back pass 63 by the existence of a line failure, a selector 36 chooses the loop-formation back pass 63, when the change to the preliminary input circuit 52 and the loop-formation back pass 63 is performed and a line failure is detected by the existence of a line failure, and it outputs a cel to the preliminary output circuit 53 through an alternative route 91. A selector 37 performs the change to the preliminary output circuit 53 and the loop-formation back pass 64 by the existence of a line failure, and a selector 38 performs the change to the preliminary input circuit 54 and the loop-formation back pass 64 by the existence of a line failure.

[0025] In drawing 2, when the failure is not detected, a cel is transmitted by the same root as the gestalt of the 1st operation explained using drawing 1. moreover -- present -- business -- the gestalt of the 1st operation explained using drawing 1 when a failure was detected by the output circuit 41 -- the same -- a selector 31 -- present -- business -- the loop-formation back pass 61 from the output circuit 41 -- selection -- changing -- a selector 32 -- present -- business -- selection is changed from the input circuit 42 to the loop-formation back pass 61. present -- business -- the cel which reached the input circuit 44 is switched with a switch 10, is usually switched with a switch 10 through the loop-formation back pass 61 via the root 71, and is sent out from the preliminary output circuit 51 via an alternative route 81.

[0026] here -- present -- business -- suppose that the failure was detected also not only in the output circuit 41 but in the preliminary output circuit 51. In that case, SERUKUTA 35 changes selection from the preliminary output circuit 51 to the loop-formation back pass 63 autonomously, and a selector 36 changes selection from the preliminary input circuit 52 to the loop-formation back pass 63 autonomously. And since the selector 35 has chosen the loop-formation back pass 63, it acts to the header transducer 26 as the forward of the cel which reached the selector 35 through the alternative route 81 from a selector 36 through the loop-formation back pass 63. Since the selector 36 has chosen the loop-formation back pass 63, the header transducer 26 rewrites the output line number in the header added to a cel not with reference to the correspondence table A but with reference to the table B with the output line number of the alternative route 91 which sets it as each circuit. The cel in which rewriting of a header was performed is outputted to the preliminary output circuit 53 through the header transducer 27 and a selector 37 via the alternative route 91 set as the switch 10 from the header transducer 26.

[0027] In the gestalt of the 2nd operation, although the alternative route 91 was set up beforehand, when a failure occurs, you may newly set up.

[0028] Moreover, in this invention, when a line failure is detected and an alternative route is used, the device in which the terminal and application of a receiving side merge the VPI value / VCI value of the header of the cel which arrived into a receiving possible value by the header transducer of the last stage which carries out termination of the PVC can also be given.

[0029]

[Effect of the Invention] it explained above -- as -- this invention -- the inside of the switch of an ATM

switching system -- beforehand -- the alternative route to a reserved circuit -- setting up -- present -- business, when a line failure is detected by the circuit By choosing a loop-formation back pass autonomously by the selector, a cel can be transmitted to a reserved circuit, using an alternative route only at turning up one physical connection, time amount to failure restoration is shortened, and it has the effectiveness that the cel abandonment by the line failure can be prevented.

[0030] moreover, it is set up beforehand -- present -- business -- even if it is the case where a line failure is detected by both the circuit and the reserved circuit, it has the effectiveness that oh, the same device can be used by the reserved circuit by which the line failure was detected by setting up two or more reserved circuits at the time of an Ecklonia or line failure detection, it can respond to a line failure flexibly, and a failure can be avoided. Also when performing n-fold-ization ($n > 1$) of a circuit at this time, it has the effectiveness that it is not necessary to build the selector which newly holds n circuits. [0031] Furthermore, it is not necessary to have the routing table usually used for root utilization time, and the same table as a table used when choosing an alternative route and performing header conversion, and has the effectiveness that effective use of mounting memory can be aimed at, by holding only the output line number switched to a reserved circuit.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] Especially this invention relates to the detour approach at the time of pass failure generating in an ATM network about an ATM switching system.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] As an example of a Prior art, there is invention of the short hits electronic switch indicated by JP,8-251184,A (it is hereafter described as an official report 1) and a non-hits electronic switch. invention indicated by the official report 1 -- the HEC error detection section -- present -- business -- the case where detected the HEC error of a transmission line and an error is detected -- present -- business -- the selector which holds physically two circuits, a transmission line and a reserve transmission line, -- using -- present -- business -- the change to the specific reserve transmission line fixed physically from a transmission line is performed.

[0003] Moreover, there is invention of the ATM switching system indicated by JP,8-242240,A (it is hereafter described as an official report 2) and the pass change approach as an example of other Prior arts. In the switch, invention indicated by the official report 2 holds both the routing table usually referred to at the time of employment, and the detour routing table referred to at the time of failure detection, changes the routing table referred to according to the existence of detection of a failure, and is usually performing selection of the root or an alternative route.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] it explained above -- as -- this invention -- the inside of the switch of an ATM switching system -- beforehand -- the alternative route to a reserved circuit -- setting up -- present -- business -- the time of detecting a line failure by the circuit By choosing a loop-formation back pass autonomously by the selector, a cel can be transmitted to a reserved circuit, using an alternative route only at turning up one physical connection, time amount to failure restoration is shortened, and it has the effectiveness that the cel abandonment by the line failure can be prevented.

[0030] moreover, it is set up beforehand -- present -- business -- even if it is the case where a line failure is detected by both the circuit and the reserved circuit, it has the effectiveness that oh, the same device can be used by the reserved circuit by which the line failure was detected by setting up two or more reserved circuits at the time of an Ecklonia or line failure detection, it can respond to a line failure flexibly, and a failure can be avoided. Also when performing n-fold-ization ($n > 1$) of a circuit at this time, it has the effectiveness that it is not necessary to build the selector which newly holds n circuits. [0031] Furthermore, it is not necessary to have the routing table usually used for root utilization time, and the same table as a table used when choosing an alternative route and performing header conversion, and has the effectiveness that effective use of mounting memory can be aimed at, by holding only the output line number switched to a reserved circuit.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] as the trouble of invention indicated by the official report 1 of the above-mentioned Prior art -- present -- business -- although the change to the reserve transmission line fixed physically is performed when a failure arises in a transmission line -- present -- business -- when a failure arises in the both system of a transmission line and a reserve transmission line, it is raised that a failure is nonavoidable. Moreover, when realizing n-fold-ization ($n > 1$) of a circuit, it is raised that the selector which holds n circuits is needed.

[0005] Moreover, since it is necessary to hold two kinds of routing table of the sometimes used [usually] routing table and the routing table referred to at the time of failure generating as a trouble of invention indicated by the official report 2, it is raised that the engine performance of an ATM switching system will be restricted depending on the capacity of mounting memory.

[0006] This invention is proposed based on the technical problem described previously, shortens time amount to failure restoration, corresponds to a failure flexibly, and it aims at preventing the cel abandonment by the line failure.

[Translation done.]

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MEANS

[Means for Solving the Problem]

[1] The failure restoration approach of the ATM switching system of this invention PVC (71) of the root is usually set up between the 2nd I/O circuit (44 43) of a circuit. present -- business -- the 1st I/O circuit (42 41) of a circuit -- present -- business -- It is the ATM switching system by which PVC (81) of an alternative route is set up between the circuit and the reserved circuit (51 52). this -- present -- business - - this -- when the line failure of the 1st output circuit (41) of the 1st I/O circuit is detected, the autonomous change to PVC of this alternative route of this usual root (81) from PVC (71) is performed, and a cel is sent out using the output circuit (51) of this reserved circuit.

[0008] [2] The failure restoration approach of the ATM switching system of this invention PVC (71) of the root is usually set up between the 2nd I/O circuit (44 43) of a circuit. present -- business -- the 1st I/O circuit (42 41) of a circuit -- present -- business -- It is the ATM switching system by which PVC (81) of an alternative route is set up between the circuit and the reserved circuit (51 52). this -- present -- business -- this, when the line failure of the 1st output circuit (41) of the 1st I/O circuit is detected Change the selection means (31 32) with which the circuit means (11) of this ATM switching system is equipped, and the output circuit table of the alternative route beforehand set as the header conversion means (22) with which this circuit means is equipped is referred to. this -- all the cell datas that flow PVC (71) of this usual root which goes to the 1st output circuit are changed so that it may flow to PVC (81) of this alternative route that goes to the output circuit (51) of this reserved circuit by which the line failure is not detected.

[0009] [3] The failure restoration approach of the ATM switching system of this invention PVC (71) of the root is usually set up between the 2nd I/O circuit (44 43) of a circuit. present -- business -- the 1st I/O circuit (42 41) of a circuit -- present -- business -- It is the ATM switching system by which PVC (81 91) of two or more alternative routes is set up between a circuit and two or more reserved circuits (51, 52, 53, 54). this -- present -- business -- this, when the line failure of the output circuit (51) of the 1st output circuit (41) of the 1st I/O circuit and the 1st I/O circuit (51 52) of the arbitration of these two or more reserved circuits (51, 52, 53, 54) is detected The selection means (31, 32, 35, 36) with which the circuit means (11 13) of this ATM switching system is equipped is changed. The output circuit table of the alternative route beforehand set as the header conversion means (22 26) with which this circuit means is equipped is referred to. this -- all the cell datas that flow PVC (71) of this usual root which goes to the 1st output circuit are changed so that it may flow to PVC (91) of this alternative route that goes to the output circuit (53) of the 2nd reserved circuit (53 54) by which the line failure of these two or more reserved circuits is not detected.

[0010] [4] The failure restoration approach of the ATM switching system of this invention PVC (71) of the root is usually set up between the 2nd I/O circuit (44 43) of a circuit. present -- business -- the 1st I/O circuit (42 41) of a circuit -- present -- business -- It is the ATM switching system by which PVC (81) of the 1st alternative route is set up between a circuit and the 1st reserved circuit (51 52). this -- present -- business -- this, when the line failure of the 1st output circuit (41) of the 1st I/O circuit and the output circuit (51) of this 1st reserved circuit (51 52) is detected The selection means (31, 32, 35, 36)

with which the circuit means (11 13) of this ATM switching system is equipped is changed. The output circuit table of the alternative route beforehand set as the header conversion means (22 26) with which this circuit means is equipped is referred to. Set up the 2nd new reserved circuit (53 54), and PVC (91) of the 2nd alternative route is set up between this 1st reserved circuit and this 2nd reserved circuit. this -- all the cell datas that flow PVC (71) of this usual root which goes to the 1st output circuit are changed so that it may flow to PVC (91) of this alternative route that goes to the output circuit (53) of this 2nd reserved circuit by which the line failure is not detected.

[0011] [5] The above [2] When the failure restoration approach of the ATM switching system of this invention of - [4] carries out termination of the pass of PVC of said alternative route, the header transducer with which said circuit means is equipped can perform merge of a VPI value and a VCI value.

[0012]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.

[0013] [Gestalt of the 1st operation] drawing 1 is drawing showing the configuration of the ATM switching system to which the failure restoration approach in the gestalt of operation of the 1st of this invention is applied. drawing 1 -- using -- present -- business -- the failure restoration approach when a failure is detected by the output circuit is explained.

[0014] the ATM switching system shown in drawing 1 -- a switch 10 -- present -- business -- it has the composition of having the Rhine card interface sections 11 and 12 of a system, and the Rhine card interface section 13 of a reserve system. The Rhine card interface section 11 has the composition of having the header transducers 21 and 22 which rewrite the header of a cel, the selectors 31 and 32 which usually choose the root or an alternative route, and the loop-formation back pass 61 for alternative route selection. The Rhine card interface section 12 has the composition of having the header transducers 23 and 24 which rewrite the header of a cel, the selectors 33 and 34 which usually choose the root or an alternative route, and the loop-formation back pass 62 for alternative route selection. The Rhine card interface section 13 has the composition of having the header transducers 25 and 26 which rewrite the header of a cel, the selectors 35 and 36 which usually choose the root or an alternative route, and the loop-formation back pass 63 for alternative route selection. moreover -- present -- business -- when the failure is not detected by the Rhine card interface section 11 of a system, it is used for it -- present -- business -- circuits 41 and 42 are connected. present -- business -- when the failure is not detected by the Rhine card interface section 12 of a system, it is used for it -- present -- business -- circuits 43 and 44 are connected. The reserved circuits 51 and 52 used when a failure is detected are connected to the Rhine card interface section 13 of a reserve system.

[0015] a switch 10 -- present -- business -- circuits 41-44 and reserved circuits 51 and 52 set up -- having -- **** -- present -- business -- a circuit 41 -- present -- business -- between circuits 44, the root 71 is usually set up. moreover -- present -- business -- the loop-formation back pass 61 is beforehand set to circuits 41 and 42. present -- business -- the loop-formation back pass 62 is beforehand set to circuits 43 and 44. The loop-formation back pass 63 is beforehand set to reserved circuits 51 and 52. furthermore -- a switch 10 -- beforehand -- present -- business -- the alternative route 81 is set up between the circuit 42 and the reserved circuit 51.

[0016] Although not shown in drawing 1, the header transducers 21-26 are equipped with the correspondence table A of the VPI value / VCI value of a header, and an output circuit, respectively. When the line failure is not detected, the header transducers 21-26 perform header conversion of the cel inputted with reference to the correspondence table A, respectively. Moreover, the header transducers 22, 24, and 26 by the side of an input circuit are equipped with the table B on which only the output line number of the alternative route at the time of a line failure is written, respectively. When the line failure is detected, the header transducers 22, 24, and 26 perform header conversion of the cel inputted through the loop-formation back passes 61-63 using Table B, respectively.

[0017] The change to the output circuit (the following -- present -- business -- it is described as an output circuit) 41 of a circuit and the loop-formation back pass 61 is performed. a selector 31 -- the

existence of a line failure -- present -- business -- a selector 32 When the change to the input circuit (the following -- present -- business -- it is described as an input circuit) 42 of a circuit and the loop-formation back pass 61 is performed and a line failure is detected, the loop-formation back pass 61 is chosen. the existence of a line failure -- present -- business -- A cel is outputted to the output circuit (it is hereafter described as a preliminary output circuit) 51 of a reserved circuit through an alternative route 81. a selector 33 -- the existence of a line failure -- present -- business -- the change to the output circuit 43 and the loop-formation back pass 62 -- carrying out -- a selector 34 -- the existence of a line failure -- present -- business -- the change to the input circuit 44 and the loop-formation back pass 62 is performed. A selector 35 performs the change to the preliminary output circuit 51 and the loop-formation back pass 63 by the existence of a line failure, and a selector 36 performs the change to the input circuit (it is hereafter described as a preliminary input circuit) 52 of a reserved circuit, and the loop-formation back pass 63 by the existence of a line failure.

[0018] the case where the failure is not detected in drawing 1 -- a selector 34 -- present -- business -- the input circuit 44 -- choosing -- **** -- a selector 31 -- present -- business -- the output circuit 41 is chosen. present -- business -- through a selector 34, with reference to the correspondence table A, a replacement of a header is performed by the header transducer 24, the cel which reached the input circuit 44 is switched with a switch 10, and a replacement of a header usually performs it with reference to the correspondence table A by the header transducer 21 via the root 71 -- having -- a selector 31 -- minding - - present -- business -- it is sent out from the output circuit 41.

[0019] moreover -- present -- business -- the case where a certain line failure is detected by the output circuit 41 -- a selector 31 -- present -- business -- the loop-formation back pass 61 from the output circuit 41 -- autonomous -- selection -- changing -- a selector 32 -- present -- business -- selection is autonomously changed from the input circuit 42 to the loop-formation back pass 61. and -- present -- business -- through a selector 34, a replacement of a header is performed with reference to the correspondence table A of the header transducer 24, and the cel which reached the input circuit 44 is usually switched with a switch 10 via the root 71, and reaches a selector 31 through the header transducer 21. It passes along the root same so far as the case where the line failure is not detected. Here, since the selector 31 has chosen the loop-formation back pass 61, it acts to the header transducer 22 as the forward of the cel which reached the selector 31 from a selector 32 through the loop-formation back pass 61. Since the selector 32 has chosen the loop-formation back pass 61, the header transducer 22 rewrites the output line number in the header added to a cel not with reference to the correspondence table A but with reference to the table B with the output line number of the alternative route 81 which sets it as each circuit. The cel in which rewriting of a header was performed is outputted to the preliminary output circuit 51 through the header transducer 25 and a selector 35 via the alternative route 81 set as the switch 10 from the header transducer 22.

[0020] [Gestalt of the 2nd operation] drawing 2 is drawing showing the configuration of the ATM switching system to which the failure restoration approach in the gestalt of operation of the 2nd of this invention is applied. drawing 2 -- using -- present -- business -- the failure restoration approach when a failure is detected by both the output circuit and the preliminary output circuit is explained.

[0021] the ATM switching system shown in drawing 2 -- a switch 10 -- present -- business -- it has the composition of having the Rhine card interface sections 11 and 12 of a system, and the Rhine card interface sections 13 and 14 of a reserve system. The Rhine card interface section 11 has the composition of having the header transducers 21 and 22 which rewrite the header of a cel, the selectors 31 and 32 which usually choose the root or an alternative route, and the loop-formation back pass 61 for alternative route selection. The Rhine card interface section 12 has the composition of having the header transducers 23 and 24 which rewrite the header of a cel, the selectors 33 and 34 which usually choose the root or an alternative route, and the loop-formation back pass 62 for alternative route selection. The Rhine card interface section 13 has the composition of having the header transducers 25 and 26 which rewrite the header of a cel, the selectors 35 and 36 which usually choose the root or an alternative route, and the loop-formation back pass 63 for alternative route selection. The Rhine card interface section 14 has the composition of having the header transducers 27 and 28 which rewrite the header of a cel, the

selectors 37 and 38 which usually choose the root or an alternative route, and the loop-formation back pass 64 for alternative route selection. moreover -- present -- business -- when the failure is not detected by the Rhine card interface section 11 of a system, it is used for it -- present -- business -- circuits 41 and 42 are connected. present -- business -- when the failure is not detected by the Rhine card interface section 12 of a system, it is used for it -- present -- business -- circuits 43 and 44 are connected. The reserved circuits 51 and 52 used when a failure is detected are connected to the Rhine card interface section 13 of a reserve system. The reserved circuits 53 and 54 used when a failure is detected are connected to the Rhine card interface section 14 of a reserve system.

[0022] a switch 10 -- present -- business -- circuits 41-44 and reserved circuits 51-54 set up -- having --
 **** -- present -- business -- the input circuit 44 -- present -- business -- between the output circuits 41, the root 71 is usually set up. moreover -- present -- business -- the loop-formation back pass 61 is beforehand set to circuits 41 and 42. present -- business -- the loop-formation back pass 62 is beforehand set to circuits 43 and 44. The loop-formation back pass 63 is beforehand set to reserved circuits 51 and 52. The loop-formation back pass 64 is beforehand set to reserved circuits 53 and 54. furthermore -- a switch 10 -- beforehand -- present -- business -- the alternative route 81 is set up between the input circuit 42 and the preliminary output circuit 51, and the alternative route 91 is set up between the preliminary input circuit 52 and the preliminary output circuit 53.

[0023] Although not shown in drawing 2, the header transducers 21-28 are equipped with the correspondence table A of the VPI value / VCI value of a header, and an output circuit, respectively. When the line failure is not detected, the header transducers 21-28 perform header conversion of the cel inputted with reference to the correspondence table A, respectively. Moreover, the header transducers 22, 24, 26, and 28 by the side of an input circuit are equipped with the table B on which only the output line number of the alternative route at the time of a line failure is written, respectively. When the line failure is detected, the header transducers 22, 24, 26, and 28 perform header conversion of the cel inputted through the loop-formation back passes 61-64 using Table B, respectively.

[0024] a selector 31 -- the existence of a line failure -- present -- business -- the change to the output circuit 41 and the loop-formation back pass 61 -- carrying out -- a selector 32 -- the existence of a line failure -- present -- business -- the change to the input circuit 42 and the loop-formation back pass 61 is performed, when a line failure is detected, the loop-formation back pass 61 is chosen, and a cel is outputted to the preliminary output circuit 51 through an alternative route 81. a selector 33 -- the existence of a line failure -- present -- business -- the change to the output circuit 43 and the loop-formation back pass 62 -- carrying out -- a selector 34 -- the existence of a line failure -- present -- business -- the change to the input circuit 44 and the loop-formation back pass 62 is performed. A selector 35 performs the change to the preliminary output circuit 51 and the loop-formation back pass 63 by the existence of a line failure, a selector 36 chooses the loop-formation back pass 63, when the change to the preliminary input circuit 52 and the loop-formation back pass 63 is performed and a line failure is detected by the existence of a line failure, and it outputs a cel to the preliminary output circuit 53 through an alternative route 91. A selector 37 performs the change to the preliminary output circuit 53 and the loop-formation back pass 64 by the existence of a line failure, and a selector 38 performs the change to the preliminary input circuit 54 and the loop-formation back pass 64 by the existence of a line failure.

[0025] In drawing 2, when the failure is not detected, a cel is transmitted by the same root as the gestalt of the 1st operation explained using drawing 1. moreover -- present -- business -- the gestalt of the 1st operation explained using drawing 1 when a failure was detected by the output circuit 41 -- the same -- a selector 31 -- present -- business -- the loop-formation back pass 61 from the output circuit 41 -- selection -- changing -- a selector 32 -- present -- business -- selection is changed from the input circuit 42 to the loop-formation back pass 61. present -- business -- the cel which reached the input circuit 44 is switched with a switch 10, is usually switched with a switch 10 through the loop-formation back pass 61 via the root 71, and is sent out from the preliminary output circuit 51 via an alternative route 81.

[0026] here -- present -- business -- suppose that the failure was detected also not only in the output circuit 41 but in the preliminary output circuit 51. In that case, SERUKUTA 35 changes selection from

the preliminary output circuit 51 to the loop-formation back pass 63 autonomously, and a selector 36 changes selection from the preliminary input circuit 52 to the loop-formation back pass 63 autonomously. And since the selector 35 has chosen the loop-formation back pass 63, it acts to the header transducer 26 as the forward of the cel which reached the selector 35 through the alternative route 81 from a selector 36 through the loop-formation back pass 63. Since the selector 36 has chosen the loop-formation back pass 63, the header transducer 26 rewrites the output line number in the header added to a cel not with reference to the correspondence table A but with reference to the table B with the output line number of the alternative route 91 which sets it as each circuit. The cel in which rewriting of a header was performed is outputted to the preliminary output circuit 53 through the header transducer 27 and a selector 37 via the alternative route 91 set as the switch 10 from the header transducer 26.

[0027] In the gestalt of the 2nd operation, although the alternative route 91 was set up beforehand, when a failure occurs, you may newly set up.

[0028] Moreover, in this invention, when a line failure is detected and an alternative route is used, the device in which the terminal and application of a receiving side merge the VPI value / VCI value of the header of the cel which arrived into a receiving possible value by the header transducer of the last stage which carries out termination of the PVC can also be given.

[0029]

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the configuration of the ATM switching system to which the failure restoration approach in the gestalt of operation of the 1st of this invention is applied

[Drawing 2] The block diagram showing the configuration of the ATM switching system to which the failure restoration approach in the gestalt of operation of the 2nd of this invention is applied

[Description of Notations]

10 Switch

11-14 Rhine card interface section

21-28 Header transducer

31-38 Selector

41 and 43 present -- business -- output circuit

42 and 44 present -- business -- input circuit

51 53 Preliminary output circuit

52 54 Preliminary input circuit

61-64 Loop-formation back pass

71 Usually, Root

81 91 Alternative route

[Translation done.]

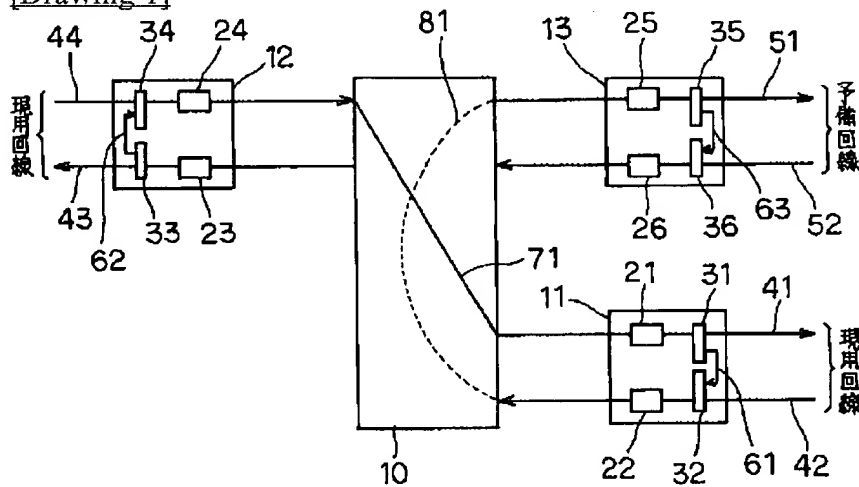
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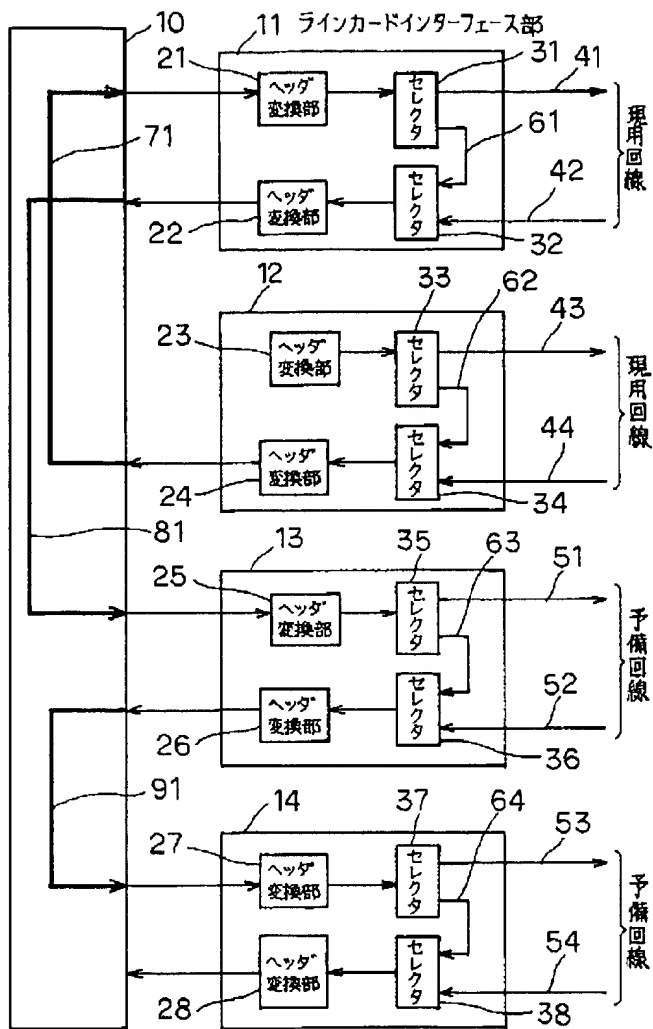
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DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]